REMARKS

The invention, as claimed in independent claim 1, relates to a light-emitting diode including a substrate, a light-generating layer on the substrate, a transparent current-spreading layer on the light-generating layer, a first electrical contact layer on the back of the substrate, and a second electrical contact layer on the current-spreading layer. The top surface of the current-spreading layer has vertical structuring (e.g., prisms, pyramids, cones, etc.) to improve the decoupling of light, and the second electrical contact layer has a lateral structure (e.g., structures 51-54 shown in Figs. 2-4) that substantially uniformly couples electrical current into the current-spreading layer.

New independent claim 14 includes all of the features of claim 1 and in addition recites that the second electrical contact layer has a lateral structure with a circumferential contact web arranged about a central contact structure. This limitation is supported in the specification at page 7, lines 6 and 16.

Claims 2, 3 and 7 have been amended to remove the objected-to optional features, which are now included in new claims 10-13 added herein.

Independent claim 1 stands rejected under 35 USC 103(a) on the basis of Krames and Gerner.

Krames is cited for disclosure of an LED with a substrate, a light-generating layer, a transparent epitaxial (said to be current spreading) layer, first and second electrical contact layers, and vertical structuring to decouple light.

Gerner is cited for disclosure of a transparent current spreading layer, and a second contact layer with a lateral structure to uniformly couple electrical current into the current spreading layer.

In the office action, it is stated that it would be obvious to modify the LED of Krames to include Gerner's current spreading layer and upper electrode with a lateral structure.

Applicants submit, however, that one of ordinary skill in the art would not consider modifying the LED-structure of Krames to include Gerner's current spreading layer and an upper electrode for a number of reasons.

First, the size of the outcoupling structure in Krames is not compatible with the thickness of the current diffusion layer in Gerner. According to Krames the vertically structured layer 1 has a texture with a depth on the order of 0.2-15 μm, typically 0.5 μm or greater (col. 6, lines 56-63). Gerner, however, teaches a current diffusion layer having a thickness between 0.05 μm and 0.5 μm (col. 2, line 39). Therefore one of ordinary skill in the art would realize that a modification of layer 1 in Krames according to Gerner would require a very thin layer 1 having a thickness comparable to or typically even smaller than the texture depth. Since the layer 1 has to be thicker than the texture depth - otherwise the layer would be divided in a plurality of unconnected parts - the texture proposed in Krames in order to archive higher extraction efficiencies, i.e., texture depth 0.5 μm or greater, cannot realized with the current diffusion layer in Gerner. A thicker current diffusion layer, however, would absorb much more light which leads to a drastically reduced extraction efficiency.

It is noted that the thickest current diffusion layer disclosed in Gerner (0.5 μm) is larger than the minimal texture depth disclosed in Krames (0.2 μm). However one of ordinary skill in the art would not combine these values since the manufacturing of such a layer requires a high precision and would be very difficult and costly. Furthermore a deviation from the given texture depth could result in a damage of the radiation generating layer which has to be avoided.

Second, one of ordinary skill in the art would not combine Krames and Gerner for fundamental reasons. According to Gerner the current diffusion layer is sufficiently thin to absorb hardly any light emission. This means that the radiation propagates almost without hindrance through the current diffusion layer. But a texture of the current diffusion layer will not increase the extraction efficiency if there is hardly any interaction between the current diffusion layer and the radiation at all. In other words, according to Gerner the current diffusion layer has to be as thin as possible in order to avoid absorption. But this would in turn decrease the extraction efficiency when applied to the epitaxial layer 1 in Krames. Therefore a combination of Gerner and Krames would not solve the given problem, i.e. to provide a light emitting diode with high effective decoupling of light.

Accordingly the subject matter of claim 1 would not be obvious from Krames in view of Gerner, and claim 1 is allowable under 35 USC 103(a). Claims 2-13 depend on claim 1 and are allowable with it.

New claim 14 includes all of the limitations of claim 1, and is thus allowable for the reasons already stated for claim 1. It in addition recites that the second electrical contact layer has a lateral structure with a circumferential contact web arranged about a central contact structure. Neither Krames nor Gerner disclose a contact layer with circumferential elements. Accordingly the subject matter of claim 14 is allowable for this additional reason as well.

All claims are submitted to be in condition for allowance, and such allowance is respectfully solicited.

No fee is believed to be due. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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